Congressional Notification Profile

DE-PS26-02NT41369

UNIVERSITY COAL RESEARCH PROGRAM, CORE PROGRAM
Trustees of Boston University

Background and Technical Information:
Project Title: "Material System for Intermediate-Temperature Solid Oxide Fuel Cell."

This project proposes to lower the cost of intermediate-temperature solid oxide fuel cells by evaluating a manufacturing technique that uses a range of low-cost materials capable of withstanding 500°-700° C. The project will evaluate "hot pressing," a technique the university developed that is expected to hold SOFC costs to $400 per kilowatt. If successful, the hot-pressed SOFCs would use more than 50 percent of the fuel they receive, and exhibit less than 1 percent power degradation while operating for an extended period of time.

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Congressional District: 08 District County: Suffolk

Financial Information:

Length of Contract (months): 36
Government Share: $199,866
Total value of contract: $199,866

DOE Funding Breakdown:
Funds: FY 2002 $199,866

Material System for Intermediate-Temperature Solid Oxide Fuel Cell

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Public Abstract

The objective of the proposed research is to investigate a materials system for intermediate temperature solid oxide fuel cell that is capable of operating between 500-700 ^{0}C with a power density greater than 0.6W/cm ^{2} at 0.7V.

A Solid Oxide Fuel Cell (SOFC)is comprised of a layered structure of a dense electrolyte sandwiched between porous and permeable electrodes (anode and cathode). In a fuel cell stack, several cells are stacked with dense interconnects placed between the anode of one cell and the cathode of the adjacent cell. They represent one of the most environmentally clean and versatile means of efficiently converting chemical energy to electrical energy from a wide variety of fossil fuels. At present, a major obstacle that limits the life and material choices for the state-of-the-art high-temperature SOFC and associated components of the generator system is the high operating temperature (1000 ^{0}C). Another key difficulty in commercialization of SOFC Power Systems is their relatively high processing cost, which is an order of magnitude higher than its gas-turbine counterparts. In response to these challenges, the proposed program is aimed at investigating a low-cost materials system for the solid oxide fuel cell that will enable its operation at 500-700 ^{0}C. Hot pressing that we have developed can be employed as a low-cost processing technique to manufacture these intermediate-temperature SOFCs at a cost not exceeding $400 per kWe.

The electrolyte, anode, and cathode materials in the SOFC system that will be investigated are based on lanthanum gallate ($La_{1-x}Sr_xGa_{1-y}Mg_yO_{3-}$ or LSGM)or ceria ($Ce_{0.9}Y_{0.1}O_{2-x}$), nickel-ceria ($Ce_{0.9}Y_{0.1}O_{2-x}$)cermet, and LSGM-lanthanum cobaltite ($La_{0.8}Sr_{0.2}CoO_3$,or LSC)composite, respectively. These material choices are based on their property information available in the literature, which indicate that they meet the operational requirements of the intermediate-temperature SOFC. These materials will be employed to fabricate single cells using known techniques. These include powder compaction and sintering, hot-pressing, slurry coating or painting and tape casting. The single cells will then be electrochemically, chemically, and mechanically evaluated to determine the viability of the material system for use in solid oxide fuel cells operating between 500-700 ^{0}C.

If successful, the proposed research will demonstrate if the chosen material system as a whole can be successfully employed to fabricate and operate intermediate-temperature solid oxide fuel cells for an extended period of time with less than 1%degradation in electrical performance at power density greater than 0.6 W/cm ^{2}, electric potential 0.7 V and fuel utilization over 50%.